

THE ASCENT OF MAN

1308

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# THE ASCENT OF MAN



 **ACCESS** ALBERTA  
program  
guide

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# SERIES OVERVIEW

**TITLE:** The Ascent of Man

**AUDIENCE:** Grades Nine - Twelve and adults

**SUBJECT:** Social Studies, Science

The privileged status of mankind seemed a matter of course 100 years ago, even 50 years ago. Most people accepted the authority of traditions that said mankind had been specially created, and the same authority was also their guide to human conduct.

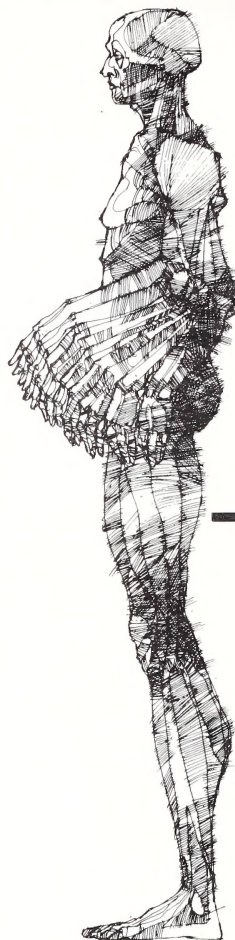
But, subtly, quietly, change has occurred; there is a kind of ongoing knowledge revolution. The public mind has begun to appreciate that processes of nature are fascinating and understandable — in logical ways — and not only by experts.

Presented by Dr. Jacob Bronowski, The Ascent of Man is no mere series of head-on lectures. The 13 programs trace a progression in mankind's relationship to nature. They begin with human evolution and with mankind's first control of other biological forms (animal and vegetable). And they go on to follow the development of different gifts or facilities by which different human cultures have tried to shape the natural world and exploit its workings. The series is a progression of discoveries, and in a sense these programs are essays of enquiry into how mankind came to be drawn, step by step, to each field of discovery and to the next.

13 programs, 52 minutes each, in color

1. Lower Than the Angels
2. The Harvest of the Seasons
3. The Grain in the Stone
4. The Hidden Structure
5. Music of the Spheres
6. The Starry Messenger
7. The Majestic Clockwork
8. The Drive for Power
9. The Ladder of Creation
10. World Within World
11. Knowledge or Certainty?
12. Generation Upon Generation
13. The Long Childhood





## 1. Lower Than the Angels

This first program looks at the evolution of mankind's unique gift of foresight and imagination. It traces the changes in anatomy and physiology that allowed upright walking, stereoscopic vision, and the precision hand-grasp which freed men to design and manufacture tools.

The program begins in the Omo Valley in the south of Ethiopia just above Lake Rudolf where the remains of early mankind and his predecessors are being uncovered at this moment. The program analyses the development of mankind's physical gifts: the movement of the pelvis; and the extension of brain use into tool making. It examines the skull of a baby, both on the site and with computergraphics at Ottawa. Development is seen explicitly happening: the cranial processes; and mathematical analysis of teeth movement reveals when and where mankind began eating meat, and where and when the use of fire began.

Studying a baby, the program outlines nature's way of trying to make the best compromise between the completely rationalizing system and the perfect physical system. Eventually there evolved a man who had neither the ferocity of the tiger nor the speed of a gazelle, but came close to both. He had the rational processes of a fine computer — and much more: foresight, imagination, planning. The viewer sees the simple movements of the baby — steps on the evolutionary path — evolving into an athlete. There is a look at the physiology of a decathlete, using X-ray, filmograph,

infra-red and slow motion as he runs or pole vaults, and his javelin becomes the spear of a hunter. Man began to live off other species; and there is a hunt sequence filmed in Ethiopia.

Then there is a shift to mankind's movements around the earth until the Ice Age began to crowd and push (described with satellite film). And then to modern day Laps, epitomizing the first society to use animal species to its own end. Evidence of man's inchoate imaginative processes is seen in the beautiful drawings and paintings in the caves of Altamira, Spain.

The program ends with man in a Magdalenian situation (say 20,000 years ago) retreating before the Ice Age but having developed the cultural step of the hand print, the signature, the image in the cave which asserts: "I am here. I have put my mark on the world."

### Main filming locations:

La Jolla, California, U.S.A.  
Omo Valley, Ethiopia  
Northern Norway  
Ottawa University Computer Centre, Canada  
Crystal Palace Stadium, London, England  
Iceland  
Altamira caves, Spain



## 2. The Harvest of the Seasons

The second program begins with the long spring at the end of the Ice Ages. Man discovers agriculture and domesticates plants and animals, imposing human will on the wild wheat and the horse.

The program visits the Bachtuari, the tribe of over two and a half million in the Zagros Mountains in Iran, who migrate each year from winter to summer pastures. They are a nomadic society — living fossils — and it took a long time for the BBC team to obtain their permission to film the annual trek. They are seen coming down from the dwindling Ice Age, down from the icy slopes to the valleys, pursuing the wheat.

Using time-lapse photography, the program shows how early wheat has evolved into modern wheat. Then to Jericho and the first beginnings of settlement around wheat and water. A sequence deals with the first principles of physics stemming from agricultural necessity: the wheel, plough, lever, wedge, all filmed in use in Afghanistan and Iran. The program has that look of the Middle East, of the fertile crescent where the neolithic revolution took place.

What purpose did this revolution serve?

It created a surplus, a grain surplus in this case, which is what happens when a people turn from nomad to settler.

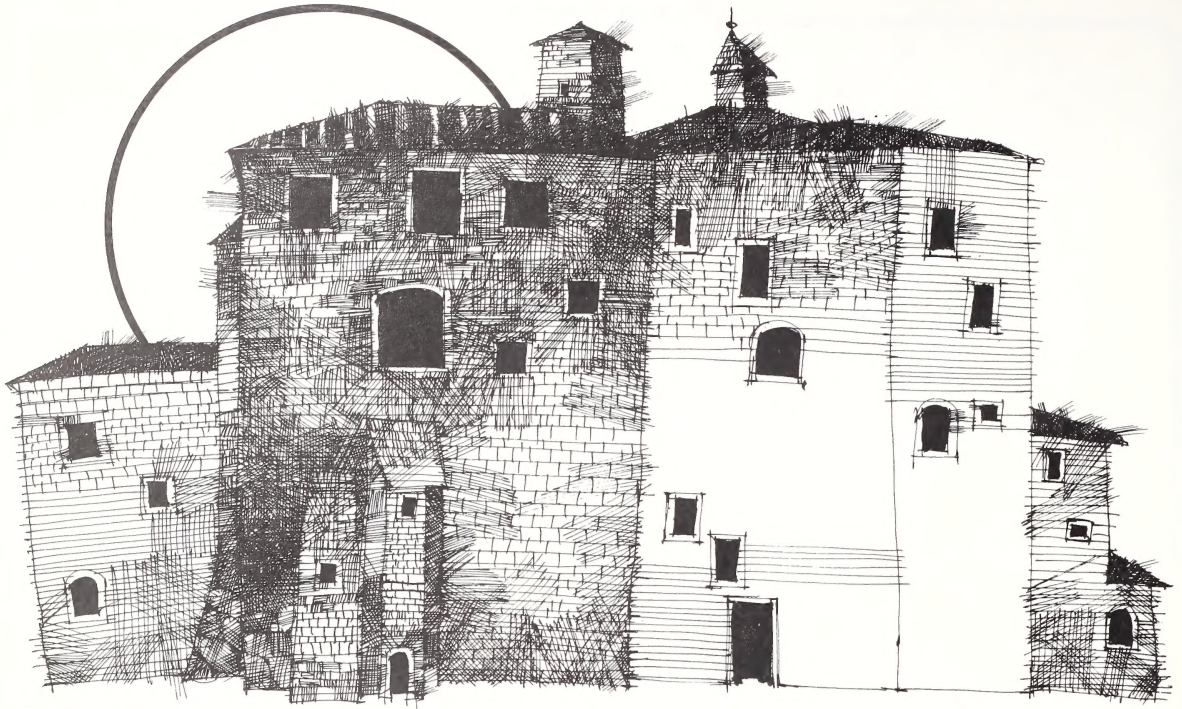
And what did the surplus breed?

It bred the other branch of civilization, the predator, the monoculture that exists by robbing. The first beginnings of organized war came out of the greed of a nomadic, predatory society ravaging and feeding on the surplus of the settlement. The greatest of the predators was Genghis Khan. Filmed in Afghanistan with 350 Uzbek and Turcoman horsemen, the segment recreates the tactics and the ferocity of the Mongols through a game which Genghis Khan introduced to foster the tactics he used. It is still played, and was filmed on the steppe with the best, wildest riders in Afghanistan.

When the dust had settled on the Mongol invasion, the conquerors were, in fact, overcome by the civilization they had been attempting to destroy. The predator settled. The program ends at the dome of Sultaniyeh, the greatest of the Mongol buildings in northern Iran and the only remnant of the great city built by Uljaitu, one of the last of their sultans. The dome was the model for later buildings including the Taj Mahal, and truly fits the description of Coleridge, the pleasure dome of Xanadu.

Main filming locations:  
Iceland  
Iran  
Jericho, Jordan  
Afghanistan





### 3. The Grain in the Stone

The third program is about the architect, the builder, the sculptor, the city. It traces the origin of science in the action of the hand. Man splits a piece of stone and puts the pieces together again to make a wall, a cathedral, a city.

The program opens with erosion, a special sequence showing in only a few seconds what happened in millions of years to the Canyon de Chelley. The great chasm was hewn by the forces of wind and water, sand and sun.

Then to man's shaping of nature: the adobe and early physical and social hierarchies of settlement. The first glimpses of a city are at Machu Picchu where agricultural surfaces forced Inca architecture into terraces and levels of structures and networks of communication, rising to the high ground of centralized authority. The city commemorated the men who built it, and it facilitates understanding of the problems of architecture and building, always confronted, usually overcome.

It was difficult to learn how to enclose any sort of large open space, so the program looks where the stresses lie in the laws of statics. The Greeks used mathematics to calculate number of columns and spacing, but what they turned out was an aesthetic conception.

The programme moves on to Segovia and flying shots of the Roman aqueduct there, which show that these stresses lay in the efficient beauty of the round, Roman arch. The stress flowed outwards in both directions from the keystone through the blocks, passed from one to the next, as the increasing vertical load was applied. A wider space could now be spanned.

And on to Cordoba where the semicircular arch went into mass production. Here one is suddenly conscious of the temerity of man trying to hold up a larger structure but still using the idea of the round arch. So he piled up the internal space with layer on layer of pillars and inner arches. Now the inventive urge to supersede the Romanesque arch was the search for physical and metaphysical light.

To Rheims, and the Gothic cathedral as the expression of spiritual aspiration towards light. In the demand for lofty vaulted heights and slender stain-glass-filled walls, where did the stresses lie? How could the city huddling around the cathedral be protected from collapsing stone? The questions were answered by putting the wall-bracing structure outside. Hence the invention of the flying buttress. The program shows how the old mason's tools were used; masons who are working there now demonstrate. As they did centuries ago, they discover with their hands as they go along, making use of ancient mathematical instruments and principles: compass, right angle, set square, plumb line, verticals and horizontals. But at times they failed in calculating stress. There is a re-creation of the collapse of Beauvais Cathedral. The temerity of man and his pleasure in building pushed him into striving to do just too much.

After Beauvais there were no new structural principles in the laws of statics until the introduction of steel and pre-set concrete. The Renaissance, in fact, returned to classical principles. But the program continues to show the temerity of man trying to have his own way with stone. Gaudi sought to impose his own vision on extravagant and seemingly impossible structures. Temerity leads to Michelangelo and the Brutus head. Michelangelo's own words about the sculptor finding the figure locked in the marble are echoed by the modern sculptor Henry Moore, seen in the same quarry that Michelangelo used. But, Moore adds: more important than the figure in the stone is the figure hidden in the sculptor's mind.

Main filming locations:  
Canyon de Chelley, Arizona, U.S.A.  
Machu Picchu, Peru  
Paestum, Italy  
Segovia, Spain  
Cordoba, Spain  
Rheims, France  
Beauvais, France  
Carrara, Italy  
Watts Towers, Los Angeles, U.S.A.



## 4. The Hidden Structure

The fourth program deals with the beginnings of chemistry, both in the ancient metallurgy of China and Japan, and in the mystical searchings of the alchemists.

The program tells of chemistry and the cutting tool of fire as a transforming, rather than a destructive element. The first major use of fire was in finding the brown metal locked in the greenstone — copper. A remarkable sequence observes the crystal structure of copper.

The search for a hard cutting edge led to bronze, and in China the science of metallurgy began. A viewing of the Shang Bronzes in Taiwan is followed by a re-enactment in Japan of the strange ritual that went into the creation of a Samurai sword; mysticism and chemistry and fire merge.

On to gold, as the program builds a bridge between metallurgy and alchemy. Gold was the symbol of immortality because it was indestructible, and we are shown beautiful golden objects from many cultures. They are followed by the classic experiment of the alchemist — the first use of gold. From there to other minerals, as man started to use them to cure illness, and a re-creation of the famous mercury-syphilis experiment. This was a break with tradition, the beginning of chemistry as an instrument of healing and the end of it as metaphysical mumbo jumbo.

The program consults Boyle, Van Helmundt, Priestley, Dalton, and performs the oxygen experiment involving the Lavoisier Quantifier. Chemistry is left standing at a time when it could go either way: as the basis for modern biology; or, as the basis for the chemistry of particle physics.

Main filming locations:

Taiwan  
Japan  
Basle, Switzerland  
Smithsonian, Washington D.C., U.S.A.  
Lima, Peru  
Tehran, Iran  
Manchester, Great Britain

## 5. Music of the Spheres

About the evolution of mathematics, the fifth program follows the pervasion of Greek ideas through Islam to Moorish Spain and Renaissance Europe. The program opens in Samos, the Greek island one mile off the Turkish coast. It was the home of the tyrant Polyclitis and the site of the Temple of Hera; an island standing on the hinge between legend and history.

Pythagoras is said to have been born in Samos. With its insistence on music and musical intervals, his is the most lasting of all the scientific theorems, having a deep meaning (nature is numerate). In Samos the program creates the music of the spheres, the music of nature, by exploring the legend and the life of the island and at the same time encompassing the history of Greek mathematical thought. Mathematics flowed from Samos into Asia Minor.

The program moves from the controlled, crystalline clarity of the Greeks to the confusion disseminated by the Arab scholars. Fruitful though the Arab involvement was, what it really did in the sight of history was to serve as a repository for classical knowledge for the West to later regain. But the period — the burgeoning of Islam — helps to explain the geography of the spread of learning. It conveys the feeling of a human melting pot, the impression of a journey, and

with it the introduction of algebra as a symbolic language of mathematics arising from the nature of the Arab scholar and his symbolistic religion. The film deals with Omar Khayyam, for instance, not as a poet but as a writer of a standard work in algebra.

Then from Iran and other Moslem countries, the program travels on the course of knowledge and eventually arrives in Granada where the Alhambra stands. The time of its construction was a period of exquisite, golden Arab symmetries. But in the main it yielded no new knowledge, only consolidation. The beautiful tile work of the Alhambra has a feeling of coldness, suggestive of a civilization dying of lack of dynamism. Yet, suddenly, bursting forth, came the translation of the Toledon tables. This sudden push into the age of the Renaissance — a sort of dung and sweat and noise of rebirth is recreated in a village called Santiana where a religious procession was filmed. The music, the human music, and the confusing raucous religious feeling are overpowering, and out of them rose a new dynamism, the clarity of Toledon tables. Here was the introduction to the West of perspective, the work of an artist, not a scientist. The artist in the Renaissance picked up the principle of the scientist. In three dimensions a picture by Durer is recreated and explored to see what the artist saw through his famous perspective eye.

In a surprising and exciting way, the program makes use of a computer. The computer “knows” the motif of Piero’s chalice, the famous Renaissance piece. In perspective, the work is on the screen. From it Doctor Bronowski evokes the meaning of the perspective experience not only as an illusion of space but also of time. From this great break with the tradition of that day the program moves in the flow of thought and vision to the observations of Copernicus and the empirical laws formulated by Keppler. Astronomy, like perspective, was now on a substantial observational footing.

Newton offered the tool to explain Keppler’s laws, to combine for the scientist space and time in one world picture. From Copernicus to Newton a kind of circularity was introduced into the world. But the mathematician was not limited by the constraints of the world. He observed with his eyes as he would have with perspective. Unlike the physicist he was not tied to the need to explain physical events; he was dealing with the language. And the language was a changing axiom.

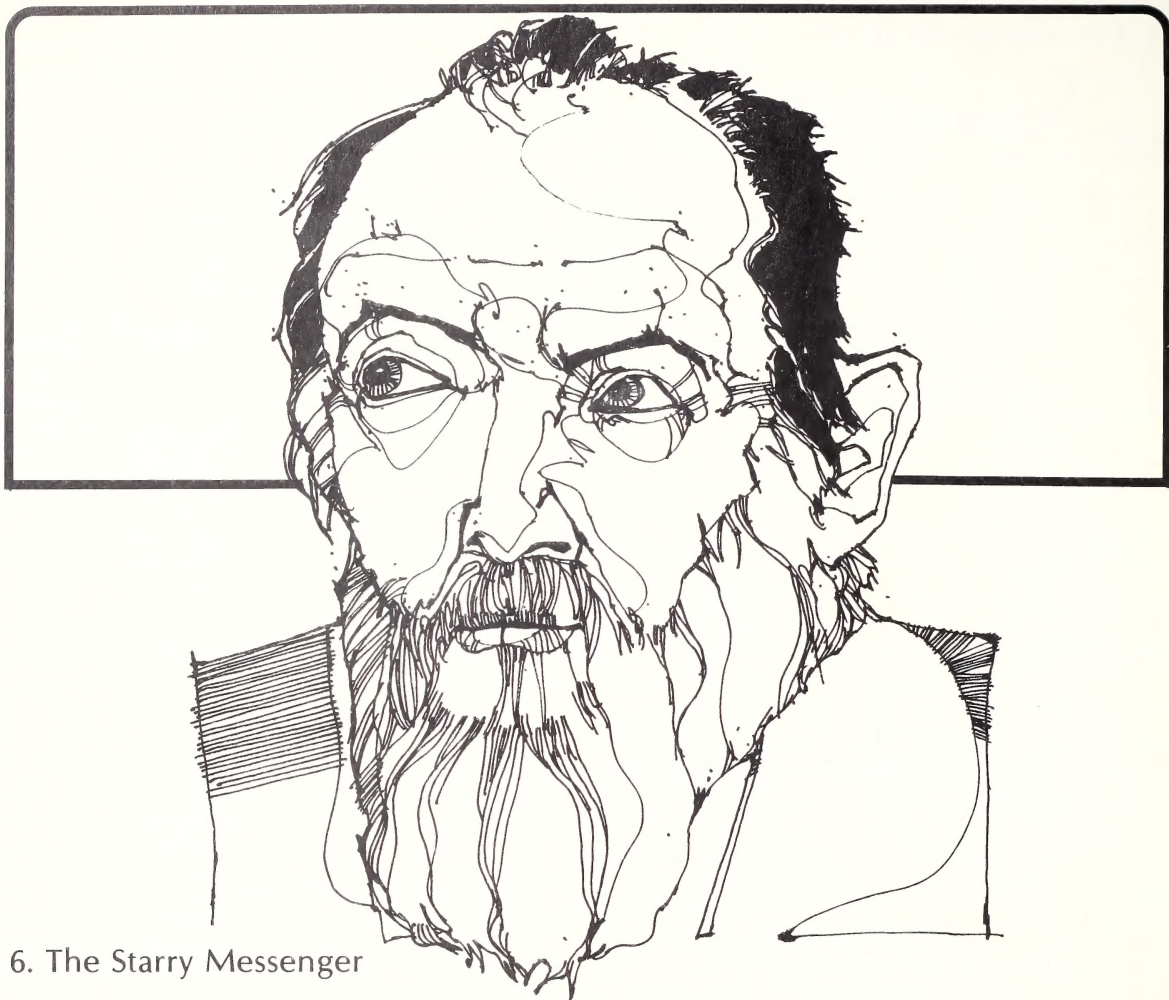
Now, the program moves to a consideration of the other side of science, the “life” sciences, the movement of thought from, say Mendel to Watson who with Crick discovered DNA. Pythagoras said that nature, the seemingly incomprehensible thing, is numerate, that it can be analysed and defined in numbers and geometry. That is what modern biology has proved.

Thus Pythagoras is still at the center of the living process of DNA. Science cannot really be evoked in film unless there is a belief in a hidden order or simplicity to be uncovered that is numerical or geometric. With the computer and Piero’s chalice this numerical and geometric logic is evoked. The chalice is in 3/4 position, rotating to a top view, with concentric circles evocative of the Copernican model. The circles are tipped to become the Capro ellipsis. The famous Euclidean axioms are broken as the demonstration continues. Up go the triangles in which the sum of the angles is either greater or less than 180°. Finally, the computer shows the assembly of DNA from the simple to the real geometry of nature.

Main filming locations:

Samos, Greece  
Isfahan, Iran  
The Alhambra, Granada, Spain  
Santillana, Spain  
Toledo, Spain





## 6. The Starry Messenger

The sixth program is about man's early attempts to map the forces which move the planets contrasting the static nature of South American astronomy with the new ideas in Catholic Europe. The central issue of the program is dogma versus scientific process.

The program begins in Easter Island with a micro society that dwells in a cul-de-sac, and is incestuous, looking within itself, navigating by patterns, bird migrations and cloud formations, with no cosmic approach to viewing the world.

Then the program moves to Copan of the Mayan Civilization, more sophisticated but still constrained, inbred, held back by the priest cult. Copan mathematics were incestuous because the Mayans, too, tended to shun the cosmic sense. Yet style and form of thought began to have some similarities with Europe where Christianity, though also constrained, was broadening into astronomical concepts. So here were the beginnings of the first overall vision of the world — the Ptolemaic view. From there to the Aristotelian view, which was a step forward because it dealt in a grand circularity of world thought. It propounded a system of the universe more workable than the inner-looking pragmatic systems in Easter Island and Copan.

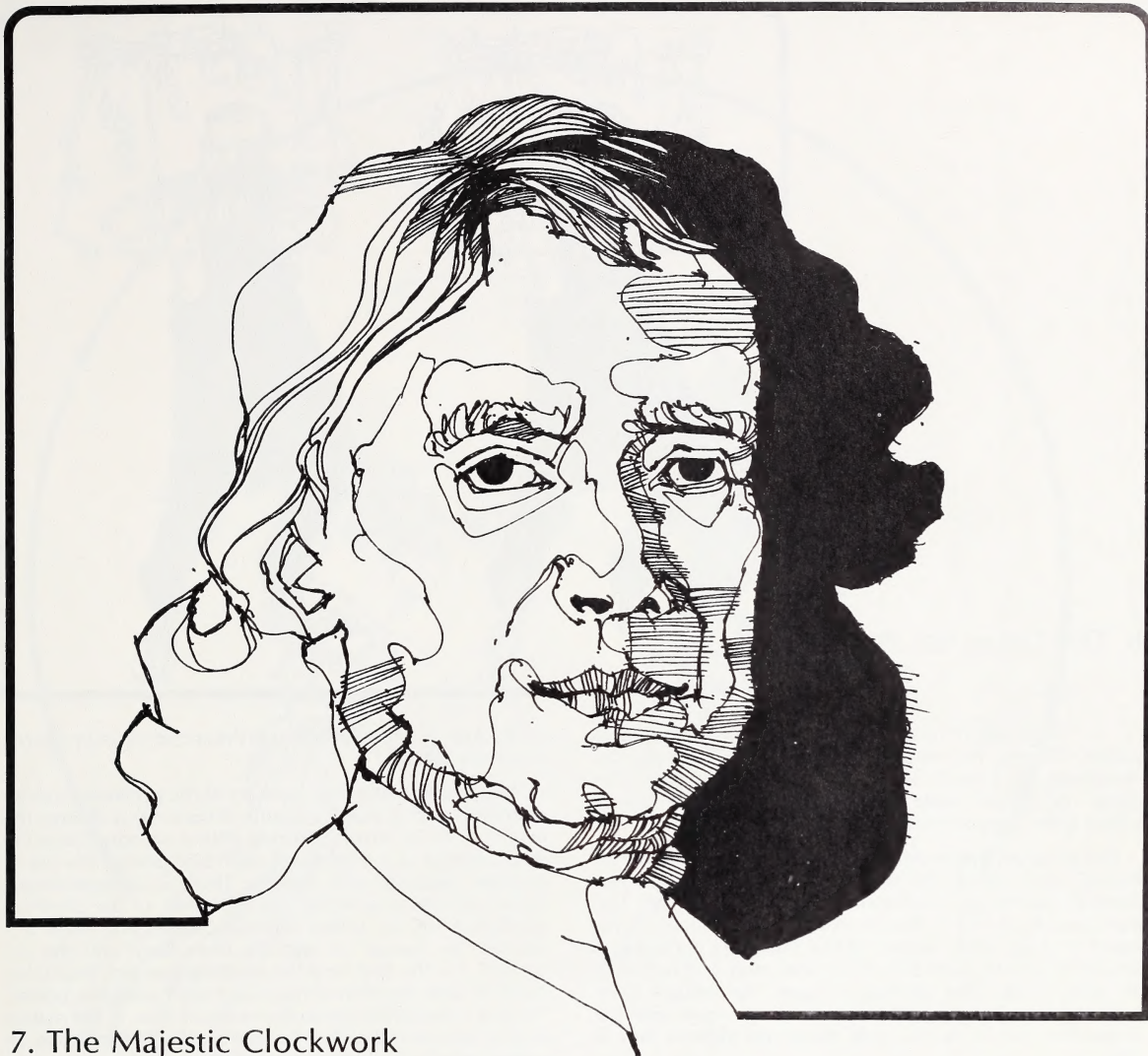
In Prague the program notes the time there by the Ptolemaic clock. It is an impossible time-telling system, but nevertheless an attempt. Then to Venice to tell the story of

Galileo. He took the work of Copernicus and with it confronted the resurgent Church. His early life in Venice is shown; his instruments; his telescope. His own words tell how he left to confront in Rome his childhood friend, Barberini, now the new Pope Urban VIII, iron epitome of Catholicism. Galileo was the liberal wedge driven into the dogmatic view of the world.

Then to the events that led to the historic trial of Galileo. The BBC team were allowed to film in the secret archives of the Vatican — with the actual trial documents — where no one has ever filmed before. In the secret chamber the trial is re-enacted in exact detail; the number and style of chairs; where the table was; the names of the judges. The recantation is heard, and then Galileo, still winner of the moral victory, dying, blind, is visited by Milton. If nothing else, he proved that the scientific revolution was about to happen, that dogma was to be defeated in the Mediterranean. Science moved north.

Main filming locations:  
 Easter Island  
 Copan, Honduras  
 Prague, Czechoslovakia  
 Smithsonian, Washington D.C., U.S.A.  
 Florence, Italy  
 Venice, Italy  
 Rome, Italy





## 7. The Majestic Clockwork

The seventh program follows the evolution that took place in the Newtonian universe of mass, space and time when Einstein introduced his Theory of Relativity. It is about the two giants who stood on the shoulders of Galileo: Newton and Einstein, two entirely different sorts of men.

In Cambridge Newton's experiment is re-created in his own rooms at Trinity College. He split light and brought it back together again into white light. He said: "You can express the natural world in mathematics."

The program moves to London: at this stage in his life Newton was obtuse, puritanical, pillar of the establishment, master of the mint, hard on forgers, constrained by religion yet at the same time a bursting genius. Apt comment on him comes from an Alexander Pope play popular at the time. It satirizes science yet gives a beautiful way of saying what Newton was about.

To Greenwich: the meridian; chronometers; the clock is the center of the universe.

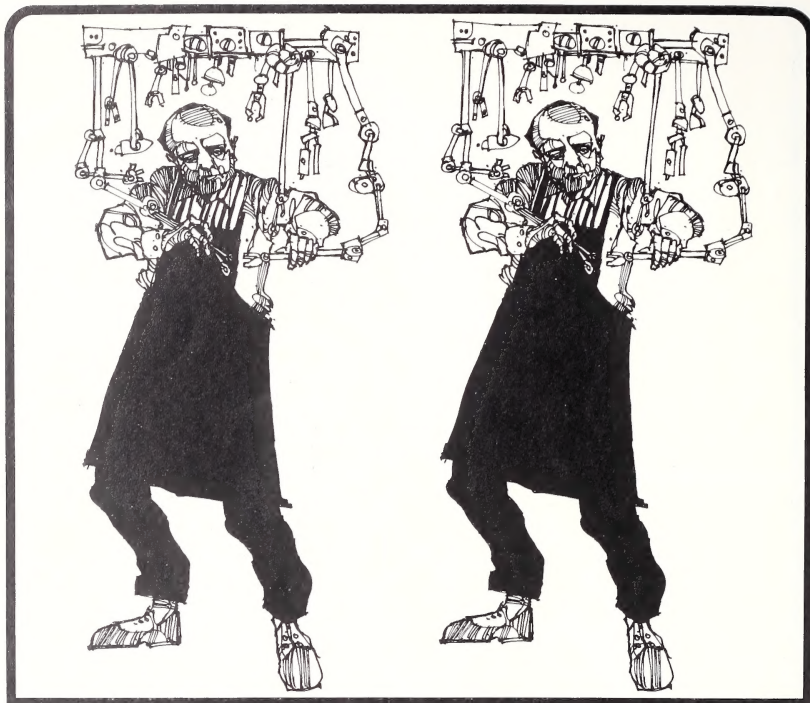
And to Berne: Newton's clockwork universe was beginning to be held in doubt. It was awaiting an Einstein to form a theory which would evolve from it but would contain all the new experiment and observation that had gone on since Newton's day. Einstein began life as a patent clerk in Berne where everyday he rode on the tram. The film follows his journey on the same tram, through the same streets, where he pondered: "If this tram were on the beam of light, what it would do? What would I do?"

We visit the cafe where Einstein used to sit, talk to his friends, and think out the simplicity of the theory of relativity. He was an ordinary working man, a simple patent clerk, who turned out to have a greater grasp of society than the few elitist groups who had gone before him.

Main filming locations:  
Prague, Czechoslovakia  
Woolthorpe, Lincolnshire, Great Britain  
Cambridge, Great Britain  
Greenwich, Great Britain  
Richmond Theatre, Yorkshire, Great Britain  
Berne, Switzerland



## 8. The Drive for Power



The eighth program is about revolutions and power. That is, the revolutions of the 18th century, the American, the French, and the Industrial revolutions. The forces of nature were harnessed, and political power shifted to the common man.

The program begins with an aria from the "Marriage of Figaro" over which are seen visuals of courtly toys, the beautiful automata used to amuse the French Court. The significance of this is Beaumarchais, watchmaker to the court of King Louis, mover of the Louisiana Purchase, a soldier of fortune, poor boy who made good, and author of the original play. "The Marriage of Figaro" was thought to be a piece of revolutionary nonsense because in one speech a commoner calls a count a rude name and makes a fool of him.

Two years later Mozart made an opera of the "Marriage of Figaro" over which are seen visuals of courtly toys, the time when science consisted of little more than building toys and watches or lining up a hundred monks, making the first one lean against the next and watching them all fall over like a pack of cards. In England the scientific establishment was discussing whether lightning conductors should have round or pointed ends. But in the meantime the seeds of revolution were growing.

The program moves to Villandry with its formal gardens that indicate the structure of court life when Beaumarchais once threaded his way through the maize. Benjamin Franklin, a man of republican principle and good broadcloth, visited this court.

A long sequence studies England during the industrial revolution, reconstructing the words and people of the time — all, like Franklin, republican men getting on with the job. At Brindley, he used to walk past the drift mine through that charcoal bareness to the water mill. There are canals, the Abbeydale forge, iron bridges, in short all the constituent elements of the industrial revolution. There is a piece on Wedgwood against a background of the white china clay mountains of Cornwall; his technology and use of canal barges to bring the china clay in and transport the crockery,

un-broken, out. Wedgwood was the archetype of provincial marching men.

The invention and development of the pyrometer (an instrument used in making quality chinaware) is shown; the evolution of the factory; the first serious introduction of the steam engine as a centralized source of power; the rise of railways, seaports, and exports. There is a home-sweet-home sequence, pointing out the effect of the chemical revolution on the urban domestic scene, and there is a journey by tramcar to visit the brass band and the fair ground. For the first time the working man was beginning really to feel that democracy came with available power. There is a sequence too on the new automata of the masses such as automated orchestras and mechanical tableaux, an avenue of silly and simple inventions.

There is a graveyard scene, a mass of iron graves, and then to Joule and his dawning realization that nature could be used as a source of power. Joule was another marching man of his age who on his honeymoon took a large thermometer with him and measured the temperature of a waterfall at the top and at the bottom in order to prove a scientific theory.

Visually this program is very attractive, because it reconstructs in every detail the age it deals with. There are no modern images, and there is a genuine feeling of a journey through early industrial England.

Main filming locations:

Chateau de Villandry, France  
La Chaux-de-Fonde, Switzerland  
L'Auberson, Switzerland  
Sallanches, French Alps  
Philadelphia, U.S.A.  
Ironbridge, Shropshire, Great Britain  
Cheddleton Mill, Staffordshire, Great Britain  
Llangollen Canal, Great Britain  
Abbeydale Forge, Sheffield, Great Britain  
Seaham Harbour, Co. Durham, Great Britain  
Crich Fairground, Derbyshire, Great Britain  
Beamish Museum, Co. Durham, Great Britain





## 9. The Ladder of Creation

**T**he ninth program is about theories of evolution and the origins of life. It traces the stories of the two men who had the same idea simultaneously, Charles Darwin and Alfred Russell Wallace, and the way their theory helped men like Pasteur to give life a bio-chemical nature.

The program is set mostly in England and the Amazon, from Down House (establishing Darwin's background) to Wallace exploring the Amazon. The controversy about the theory of evolution at the Linnaean Society is examined, and to visualize what the fundamentalists believed, there is a reconstructed sequence of spontaneous generations of mice and flies growing out of dirty vests.

The program moves to Pasteur and where he worked in Paris and the French wine country; to Miller and Orgell, and their creation of pre-biotic molecules. The laboratory process is linked to how nature performs with lightning and lava, dramatizing the microcosm that nature has achieved throughout evolution.

Main filming locations:

Down House, Kent, Great Britain

Vale of Neath, Glamorgan, Great Britain

French Guiana

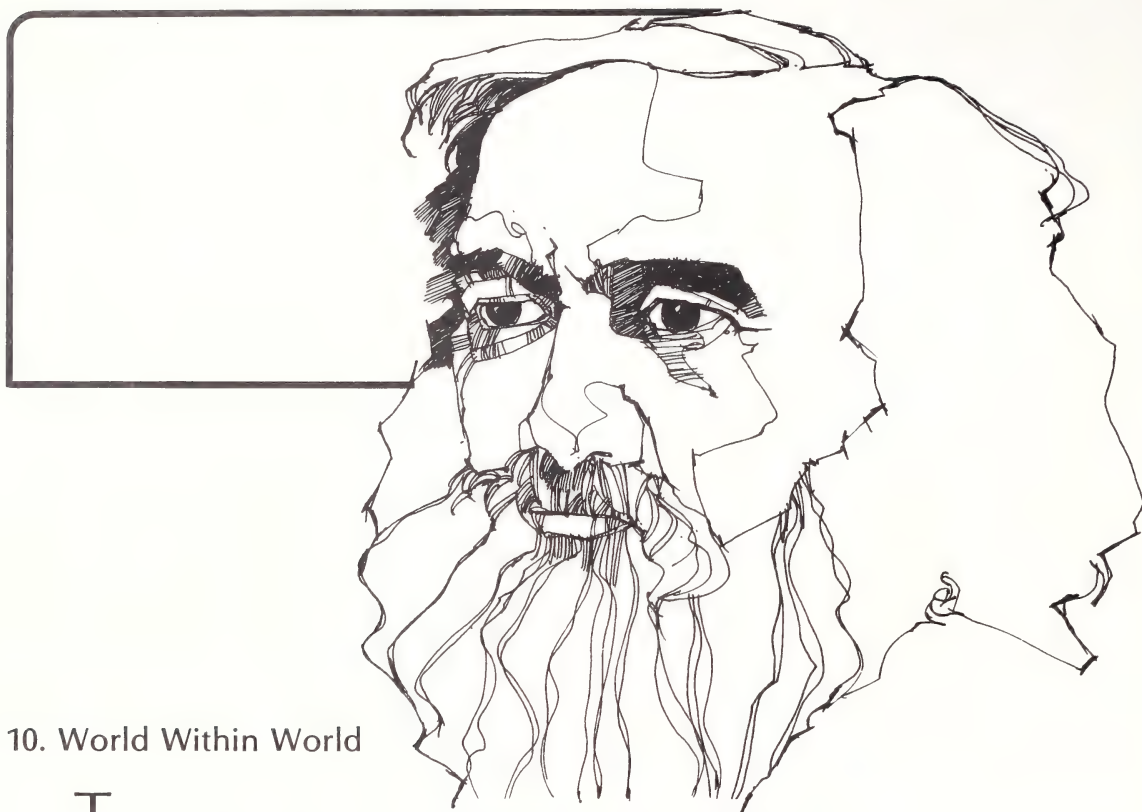
Manaus and Rio Negro, Brazil

Arbois, French Jura, France

San Diego, California, U.S.A.

Iceland





## 10. World Within World

The tenth program explores the world inside the atom. It traces the story of the men and ideas that made physics in the 20th century the greatest achievement of the human imagination. An attempt is made to answer the question: What is matter?

The program begins with the startling appearance of crystals — the inner structure of nature — and continues into diamond cleaving. At a salt mine in Poland (Wieliczka, a fantastic place full of working 17th century machinery made of wood with a church carved underground in salt) the magical nature of crystals is explored. Mendeleyev and his table of elements are introduced.

The fingers of a blind girl explore the features of a face, an old face. She describes what she feels and imagines the face to be. The images of the old man, also blind, are frozen on various screens in photographs and in drawn and painted reproductions by Topolski, made specially for the program. They are executed from almost every angle, both physical and figurative, a series, in effect, of many changing portraits. The thesis evolving from this beginning is that with all its ingenuity modern physics has proved that there is no final answer, that uncertainty remains.

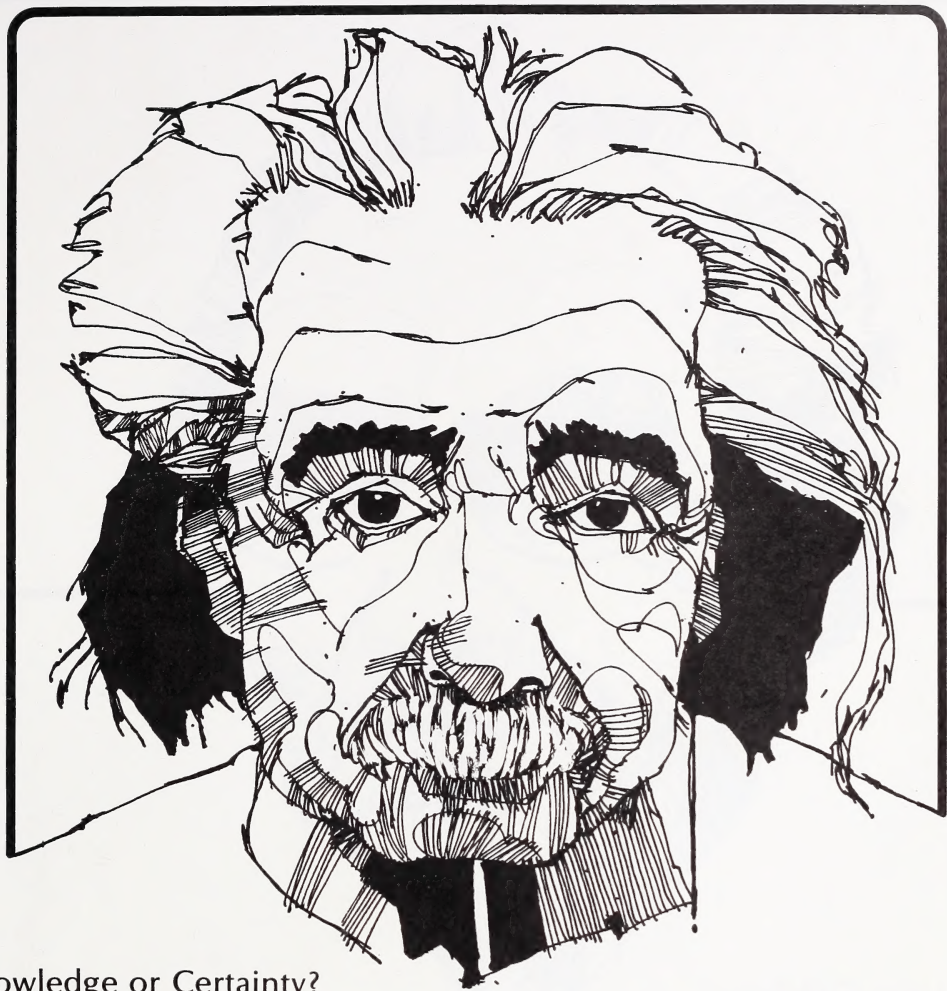
This is followed by a Dali-like landscape on a flat area where the same old man's head stands 25 feet high on the beach. Laid out around it are the instruments of the spectrum, the pieces of technology by which, given an infinitely tunable knob, a man can tune his way through the spectrum and examine that human head in every possible way. Each machine, each piece of this spectrum, has its point of certainty and point of uncertainty, its point of resolution and its point of irresolution. This head is seen through radar infrared, thermography, and through the machines that work in the visible light spectrum — the light microscope, the ul-

traviolet microscope, X-rays, the electro-microscope and ultra-violet light. At each point the resolution or irresolution of the image can be seen. And there is more to see. Sometimes the viewer sees beneath the bone; sometimes he sees the chromosome; all coming out from this strange landscape.

The program moves to the Gauss Observatory in Gottingen, to the wonder children of Max Born — Heisenberg, Schrodinger, Oppenheimer. The de Broglie atom is viewed on a computer, examining the degradation of wave particle into particle. Gottingen is the university town where 20th century physics began; it is the Cambridge of England or the Kyoto of Germany. Steam trains were specially laid on by the BBC between Gottingen and Berlin as symbols of the intellectual and international interchange of that time. The beginnings of Nazism are intermixed with views of the Blumenbach skull collection, ominous reminders of Hitler's "scientific" evidence. The train becomes the symbol for the escaping physicists — Einstein, Fermi, Szilard.

On to the work of Planck, Bohr, and Rutherford, and the houses where they lived and worked. Into the neutron, fission, fusion, and to the grave of Boltzmann who first saw the structure of the atom and died of a broken heart. The program is colored by images like cubist paintings suggesting the spirit of the age and the search for an inner geometry of matter. The authorities at Oak Ridge made their whole marvellous cathedral of physics available to the BBC team who filmed experiments using the huge reactor there.

Main Filming locations:  
Wieliczka, Poland  
Copenhagen, Denmark  
Oak Ridge, Tennessee, U.S.A.  
Vienna, Austria



## 11. Knowledge or Certainty?

The eleventh program is a personal program about information and responsibility: the moral dilemma of the scientist in our own time. The Principle of Uncertainty in physics holds good for all human knowledge.

The program moves to the story of Szilard's involvement with the Einstein letter, the Szilard patents, and his change of heart with the delayed realization of what he and Einstein had done to Hiroshima where the clock melted and stopped at 8:15. In fact the clock is stopped and actually melted on the screen. The viewer sees it ticking, and then destroyed by laser, to melt in slow motion to an exact replica of the relic that everyone knows. A sequence on Hiroshima follows; a reconstruction of the bomb, of the explosion, using slow motion, fire and images of the modern city.

To Auschwitz: the corridors in the crematoria, the human hair, the piles of chamber pots and toothbrushes, the stagnant pool which looks like any other pool — but the bottom of it, which is white, contains about four million Jews.

Main filming locations:  
 Holkham Beach, Norfolk, Great Britain  
 Gottingen, Germany  
 Jerxheim, Germany  
 San Diego, California, U.S.A.  
 Hiroshima, Japan  
 Aushchwitz, Germany

## 12. Generation Upon Generation

The twelfth program is about the revolution mathematics and physics brought to biology.

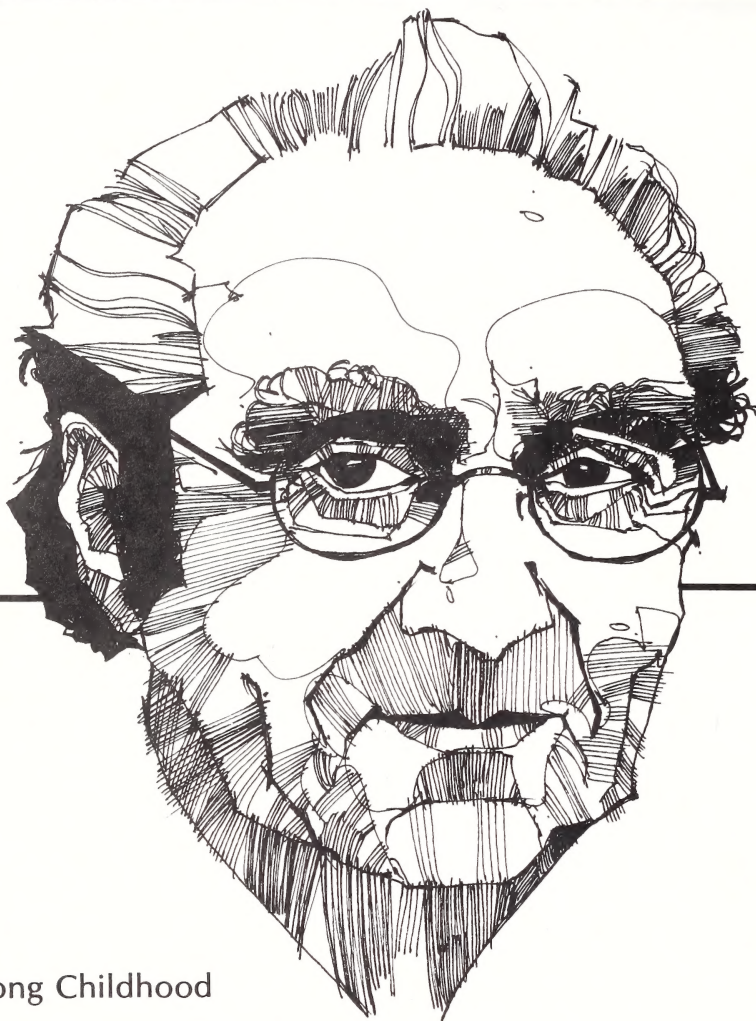
The program opens at Brno, Czechoslovakia, where Mendel lived, his experiments are carried out in the same monastery where he worked. Remarkable sequences of peas developing are proof again of Mendel's Law.

The program moves to Watson, Crick, and their model of DNA, genetic engineering, and the scientists' huge responsibility inherent in these discoveries. On film, a salamander is grown from a body cell.

The program ends with a plea, a plea for love, perhaps; sex in all things is nature's way of keeping evolution going. There is a rather beautiful love sequence showing biological film of the division of cells interplayed with the meeting of man and woman. The words — the scientific words — are those of Donne from his poem, "The Ecstasy."

Main filming locations:  
 Vienna, Austria  
 Brno, Czechoslovakia  
 Ottawa University Computer Centre, Canada





### 13. The Long Childhood

The thirteenth program is about the way each age, each culture has limited the opportunities of the child, turning him — too early — into a carbon copy of his father.

Although this is a personal program by Doctor Bronowski, it is like the rest of the series, concerned with the process system. There are three main locations: Iceland where the first real democratic parliament was called; Bronowski's home in La Jolla; and the Omo Valley in Ethiopia.

The program is political in that it discusses what democracy is and how it started. It deals with the democracy of knowledge as opposed to the aristocracy of knowledge. It is scientific in that it deals with the long childhood of man, the long childhood in terms of the neoteny of man, the nature of the brain, of the organizational frontal lobes, of the hand and the speech areas. At the same time it is concerned with the long childhood of history — with man at various ages and with his investment in the child as the instrument of cultural evolution.

The program turns to a young man of the Pre-Renaissance, Erasmus. A 1350 Mass is filmed in a beautiful Romanesque church in Italy, as the story is told of the intellectual boy who has to go into the Church in order to exercise his mind. He can learn to read, to read a foreign

language, to write, but he must not question. That is the 11th Commandment: Dogma. Thus once again the critical issues are approached of sciences versus authority and of responsibility.

Doctor Bronowski gives his personal creed, taking to task science's retreat from society, expressing the worry over the distance between government and people, between knowledge and power, between knowledge and people. Specifics such as ecology, pollution and so on, are dealt with. He puts forward a philosophy that is optimistic, reasonable, but taking into account the difficulties.

The series ends back to where it all began, in the Ethiopian Valley. Bronowski calls up the images from history or from preceding programs, but for the viewer there is always a sense of being there with him and oneself.

Main filming locations:  
 Iceland  
 La Jolla, California, U.S.A.  
 Easter Island  
 Jerusalem  
 Iran  
 Loro Ciuffena, Italy  
 Omo Valley, Ethiopia







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